SUBJECT: SOFTWARE DESIGN 2	ANNEXURE(S) None	PAGES 5	TIME 3 HRS
CODE: SDN260S	DATE 03 September 2024	MARKS 70	

Cape Peninsula University of Technology

FACULTY OF ENGINEERING

ASSESSMENT I: SEMESTER TWO

COURSE: BET: COMPUTER ENGINEERING

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MODERATOR (EXTERNAL)	:	N/A

SPECIAL INSTRUCTIONS

1. Answer both questions
2. Answer each question in a separate project
3. Write your name, student number and station number on top of the program
4. Zip together the folders of the two project files and submit as one zipped file on Blackboard
5. Be sure to add comments to your program code to make it understandable

QUESTION 1:   [40]

There are two important categories of functions in computer programming: recursive functions and non-recursive functions. Typically, a function that can be implemented recursively can alternatively be implemented iteratively (that is the non-recursive version). In this task, you will design two methods, one recursive, the other non-recursive (i.e. iterative), both for determining the maximum value of a given array of numbers. Use the Java programming language. As part of the solution, the Java application will do the following:

- Generate a 10-element array of random integers in the range 1 to 50 (inclusive)   [5]
- Use a non-recursive algorithm (method) to determine the maximum value of the array generated in the previous step. You have to design and implement this method. Please note that you may not make use of methods in the Collections framework as part of your solution   [10]
- Use a recursive algorithm (method) to determine the maximum value of the array. You have to design and implement this method. Please note that you may not make use of methods in the Collections framework as part of your solution   [10]
- Display the generated 10-element random-integer array on the output window   [3]
- Display the result of computing the maximum value of the array using the non-recursive method on the output window   [3]
- Display the result of computing the maximum value of the array using the recursive method on the output window   [3]
- Write the information displayed on the output window to a text file, exactly as it is printed on the output window   [6]
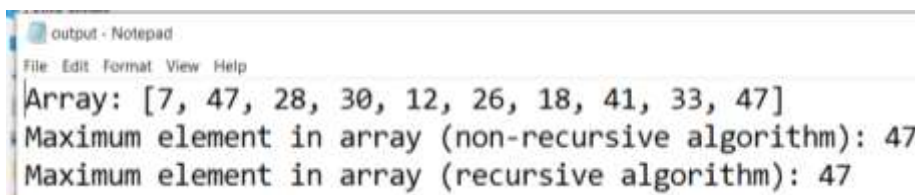
Please refer to the screenshot below for an example of the expected results of running this application.

Screenshot of result of running the Java program in NetBeans

```
Array: [7, 47, 28, 30, 12, 26, 18, 41, 33, 47]
Maximum element in array (non-recursive algorithm): 47
Maximum element in array (recursive algorithm): 47
------------------------------------------------------------------
BUILD SUCCESS
```

Screenshot of result of running the Java program written to a text file:

```
output - Notepad
File Edit Format View Help
Array: [7, 47, 28, 30, 12, 26, 18, 41, 33, 47]
Maximum element in array (non-recursive algorithm): 47
Maximum element in array (recursive algorithm): 47
```

QUESTION 2: [30]

Input validation forms an important part of every well-designed software application. In this task, you are required to design a program that validates a phone number entered by a user, which should belong to one of the main mobile network operators in South Africa (i.e. Vodacom, MTN, Telkom Mobile and Cell C). The phone number ought to be in the format: XXX-XXX-XXX, where:

- The first three digits represent the code, which determines the mobile network to which the number belongs
- The next three digits are separated from the three-digit code by the dash (-) character
- The last four digits are also separated from the preceding three digits by the dash character.

The following requirements apply to the code (the first three digits) of the phone number:

- The first digit of the code is always a zero (0)
- The second digit of the code lies in the range 6 – 8 (inclusive)
- The third digit of the code lies in the range 1 – 4 (inclusive)
- Additionally, the codes 076, 078 and 079 are also valid

The other seven digits have no restriction placed on them. The Java program you design will do the following:

Request the user to enter a phone number, advising the user regarding the format in which to enter the number (i.e. the format XXX-XXX-XXXX)

- Validate the phone number using a regular expression [10]
- The program will give the user up to three attempts to enter a valid phone number. If after three attempts the phone number entered is still invalid, the program will terminate, informing the user that the number of attempts has been exceeded [6]
- Once a valid phone number has been entered, the program will determine the network to which the number belongs, after which it will display the information on the output window as: [14]
  - Entered number
  - Code
  - Number (without code)
  - Network to which the number belongs
- For the codes that apply to the various mobile network operators, refer to **Table 1** below [**Hint**: *the mobile network to which the phone number belongs can be determined based only on the third digit of the code of the phone number*]
- Please refer to the screenshots below for the expected results of running the program

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Screenshot of result of running the Java program in NetBeans (three invalid attempts)

```
Please enter the phone number (in the format: xxx-xxx-xxxx):
065-123-4567

Invalid input. Please enter the phone number (in the format: xxx-xxx-xxxx) (2 attempts left):
075-012-3456

Invalid input. Please enter the phone number (in the format: xxx-xxx-xxxx) (1 attempts left):
077-333-4444

Number of attempts exceeded. Terminating program ...
------------------------------------------------------------------------
BUILD SUCCESS
```

Screenshot of result of running the Java program in NetBeans (third attempt valid)

```
Please enter the phone number (in the format: xxx-xxx-xxxx):
021-012-3345

Invalid input. Please enter the phone number (in the format: xxx-xxx-xxxx) (2 attempts left):
085-213-4321

Invalid input. Please enter the phone number (in the format: xxx-xxx-xxxx) (1 attempts left):
071-123-4567

The phone number [071-123-4567] is valid

Code: 071
Number: 123-4567
Network: Telkom Mobile
------------------------------------------------------------------------
BUILD SUCCESS
```

Table 1: Mobile number codes for the South African mobile network operators

Mobile Network Operator	Mobile Number Code
Telkom Mobile	061
	071
	081
Vodacom	062
	072
	076
	079
	082
MTN	063

	073
	078
	083
Cell C	064
	074
	084

End of Assessment